QUALITY ASSURANCE PROJECT PLAN
FOR THE
MASTER METALS, INC. REMOVAL ACTION
Cleveland, Cuyahoga County, Ohio

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Quality Assurance Project Plan, Revision 0
Removal Design / Removal Action for the
Master Metals, Inc. Site
Cleveland, Ohio

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LIST OF ATTACHMENTS

LIST OF ACRONYMS/ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
AOC	Area of Contamination
ASTM	American Standards for Testing Materials
BNA	Base-Neutral-Acid Extractables (Semivolatile Organics)
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
COC	Chain of Custody
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
CRL	Central Regional Laboratory
DCF	Document Control Management
DQO	Data Quality Objective
EMSL	Environmental Monitoring and Support Laboratory
FSAP	Field Sampling and Analysis Plan
GMPP	Groundwater Monitoring Program Plan
ICP	Inductively Coupled Plasma
ICVS	Initial Calibration Verification Standard
MMI	Master Metals, Inc.
MS/MSD	Matrix Spike/ Matrix Spike Duplicate
µg/kg	Micrograms/kilograms
NIST	National Institute of Standard Technology
NPL	National Priorities List
NTU	Nephelometric Turbidity Units
OSC	On-Site Coordinator
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PCBs	Polychlorinated Biphenyls
PM_{10}	Particulate matter less than 10 microns
ppb	Parts Per Billion
ppm	Parts Per Million
QA QC	Quality Assurance/ Quality Control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
RPD	Relative Percent Differences
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI FS	Remedial Investigation/ Feasibility Study
RD RA	Remedial Design/ Remedial Action
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act
SAS	Special Analytical Services
SMC	Sample Management Coordinator

SOP	Standard Operating Procedure
SRM	Standard Reference Materials
SOW	Statement of Work
SW846	Test Methods for Evaluating Solid Waste 1986.
TAL	Target Analyze List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TPH	Total Petroleum Hydrocarbon
TSP	Total Suspended Particulate Matter
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
XRF	X-Ray Fluorescence

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed by ENTACT & Associates, LLC (ENTACT) for the Master Metals, Inc. Site for use in conjunction with the Removal Design/Removal Action (RD/RA) Workplan and Health and Safety Plan. These are distinct documents that form the project operations plan intended to guide field personnel, contractors, and other involved parties in all aspects of field operations. This QAPP will provide QA procedures for activities during the removal action performed in accordance with the Administrative Order of Consent (AOC) for the Master Metals Superfund Site located in Cleveland, Cuyahoga County, Ohio, Docket No. _____.

A Phase I Time Critical Removal (TCR) for lead-impacted materials has already been conducted at the MMI site to remove contamination that posed an immediate risk to human health. Following the Phase I TCR, the Phase II EE/CA investigation was performed to delineate and evaluate the nature and extent of lead contamination remaining at the site to determine the appropriate non-time critical removal action (RA) needed to address existing site conditions. The removal action covered under this QAPP will address the remaining lead contamination in soils within the site and along the site perimeter to complete all necessary remedial action in accordance with the AOC.

The United States Environmental Protection Agency (USEPA) policy requires that all remedial activities be under the control of a centrally managed QA program. This requirement applies to all environmental monitoring activities supported by the EPA. Each contractor that generates data has full responsibility to implement minimum procedures to ensure that precision, accuracy, representativeness, completeness, and comparability of these data are known. To meet this objective, this site specific QAPP has been prepared detailing QA/QC procedures to ensure data generated during the remedial activities are accurate, precise, comparable and complete and therefore, representative of site conditions.

This QAPP will serve as a controlling mechanism during the performance of the sampling and analysis activities to detail procedures to ensure that technical data gathered during the construction phase of the interim measures are accurate, precise, complete, and representative of actual field conditions and meet minimum requirements of the design. All QA/QC procedures will be structured in accordance with applicable technical standards, EPA requirements, and regulations in general accordance with the USEPA Region 5 Model RCRA QAPP guidelines.

1.2 SITE/FACILITY DESCRIPTION

1.2.1 Location

The Master Metals Site (the "Site") encompasses approximately 4.3 acres in the "flats" area of downtown Cleveland, a heavily industrialized sector of the city. The Site includes the former Master Metals Inc. lead facility (the "Facility") located at 2850 West Third Street, Cleveland and stockpiled soils removed from the surrounding contaminated residential property at 1157, 1159 and 1167 Holmden Avenue (the "Holmden Properties") where lead-impacted material from Master Metals was deposited as fill (USEPA, 1999). Railroad tracks border the site on two sides and the LTV Steel facility lies to the east and south. The

Cuyahoga River is located approximately 1,500 feet to the east and athletic field and playground are situated approximately 1,000 feet to the west. The nearest residential property to the former facility is approximately 2,000 feet to the northwest. (USEPA, 1999).

1.2.2 Local Geology, Hydrology and Hydrogeology

The glacial and post-glacial surficial material in the vicinity of the MMI site consists of tills, lacustrine, and fluvial deposits. The glacial deposits are generally less than 40 feet thick in the site area and overlay a Devonian/Pennsylvanian-aged bedrock consisting of unconsolidated shale and sandstone (E&E, 1993).

Site investigations conducted at the site between 1990 and 1998 indicate that fill is present beneath the site to an approximate depth of four feet, with native soils of silty clay found at five feet (WWC, 1990). The water table is encountered at an approximate depth of 10 feet (WWC, 1990).

1.3 SITE/FACILITY HISTORY

1.3.1 General History

The facility was constructed in 1932 on slag fill by National Lead Industries, Inc. (NL) who owned and operated the facility as a secondary lead smelter, producing lead alloys from lead-bearing dross and scrap materials. NL also engaged in battery cracking operations at this facility. In 1979, the facility was purchased from NL Industries by MMI who continued to run secondary lead smelter operations.

As part of their operations, the Master Metals facility received lead-bearing materials classified and regulated under Resource Conservation and Recovery Act (RCRA) as D-008 hazardous waste from off-site sources (USEPA, 1999). This waste was converted into lead ingots using pot and rotary furnaces equipped with baghouses to collect particulate matter from the furnace that consisted predominantly of lead dust. The sludge that accumulated in the furnaces after smelting was classified as K069 waste hazardous waste. Finished lead ingots were stored in a roundhouse at the north end of the property prior to shipment off-site.

Based on background information, the by-products produced from smelting operations included furnace flux, slag, dross, baghouse fines and furnace sludge (USEPA, 1999). With the exception of slag, which was tested and disposed of off-site, most of the lead-bearing by-products were recycled back into the furnace. Cooling water used in the operations was diverted to the City of Cleveland's sewer system.

On November 19, 1980, Master Metals filed a "Part A permit" pursuant to the newly-regulated RCRA requirement, and obtained an "interim status" under RCRA to operate specific waste piles and treatment units, as well as container-based storage area for the hazardous lead-bearing materials. On January 11, 1982, Master Metals filed for Chapter 11 bankruptcy through the U.S. Bankruptcy Court for the Northern District of Ohio but subsequently went into reorganization and operations at the facility continued. Though Master Metals had submitted a Part B RCRA application sometime prior to November 8, 1985, on that date the facility lost interim status for the hazardous lead-bearing waste piles at the facility for failure to comply with financial requirements of 40 CFR Part 265, Subpart H.

Violations relating to poor operating practices are documented in various state and federal agency reports.

On June 15, 1987, a complaint of violations of RCRA was filed by the United States seeking closure of the D008 and K069 waste piles. In response to this action, Master Metals and the U.S. entered a Stipulation to resolve these RCRA violations as well as financial responsibility.

1.3.2 Past Regulatory and Data Collection Activities

Numerous investigations have been conducted by MMI at the facility between 1990 to 1998 to determine the nature and extent of constituents of concern related to former operations. These investigations are summarized in the following subsections.

1.3.2.1 Compliance Technologies, December 1990

Compliance Technologies, Inc. (CTI) conducted a Phase II environmental assessment of the MMI site from December 3 through December 11, 1990. The investigation included the advancement of 31 soil borings to a maximum depth of 10 feet, and the installation of four monitoring wells to a depth of 15 feet to evaluate subsurface and groundwater conditions beneath the MMI facility and determine the impact of prior slag disposal/landfill activities on these media (CTI, 1991b).

Forty-four subsurface soil samples were collected from 31 borings located in or near the MMI facility. The samples were collected from depths ranging between two to ten feet below ground surface (CTI, 1991b). The soil samples were submitted to BHM Analytical Laboratory, Chagrin Falls, Ohio and analyzed for eight RCRA metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver. The analytical results showed on-site lead concentrations ranging from 18.1mg/Kg to 14,070 mg/Kg, with lead levels one to two orders of magnitude above the other metals detected. Off-site concentrations of lead in subsurface samples ranged from 7.85 to 55 mg/Kg. Slightly elevated concentrations of chromium and cadmium were observed in only 17 of the 44 samples. Sample locations and the associated lead concentrations are shown in Figure FSAP 1.

Groundwater was reported to be present between three to ten feet across the relatively flat facility. Four groundwater samples were collected from the newly-installed monitoring wells on December 28, 1990 using hand bailers and were not filtered. Total lead concentrations ranged between 0.45 mg/L to 1.39 mg/L.

In addition to the soil samples, two samples were collected the brick and slag material and analyzed for the TCLP 8 RCRA Metals, reactive sulfide, total cyanide, pH and flash point to determine if these materials were hazardous by characteristic (CTI, 1991b). Lead was present in the slag material at 7,075 mg/Kg with leachable lead detected in the slag material at 16.1 mg/L.

1.3.2.2 Ecology & Environment, July 1992

On July 14, 1992, Ecology and Environment (on behalf of the U.S. EPA) collected seven surface samples on-site (SS1 - SS7) and three off-site surface soil samples from outside the fence to the east, south and west (SS8 – SS10) as part of a site assessment and hazard evaluation of the MMI facility. All soil samples were submitted to American Environmental Laboratories, Inc. of Bedford, Ohio for analysis of the eight RCRA metals.

Lead concentrations in the on-site surface soil samples ranged from 6,020 to 115,000 mg/Kg. Off-site

surface soil samples collected outside the fence showed lead concentrations ranging between 24,000 to 43,100 mg/Kg (E&E, 1992). Sample locations and the associated lead levels are presented in Figure 1-2. Once again, lead values were 1-2 orders of magnitude higher than the seven other metals. Some results exhibited minor arsenic, barium, cadmium, and chromium concentrations, relative to the co-located lead concentrations (E&E, 1992).

In July 1992, Ecology and Environment (on behalf of U.S. EPA) collected samples proximate to the facility property to determine if the facility contaminants were subject to airborne transport. Analysis of these samples (SS8 - SS10) for RCRA metals showed total lead levels of 24,000 - 43,100 ppm (see Figure 2-1).

1.3.2.3 Phase I Time Critical Removal

As part of the time-critical removal, all exposed on-site surface areas (e.g., not covered by concrete) were excavated to a maximum depth of two feet or until slag fill material (e.g., slag, cinders, etc.) were encountered, whichever came first. XRF information collected from the floor of the excavations exhibited lead concentrations up to 39,000 ppm in the remaining slag fill material. The TCR also included the demolition, decontamination and off-site transportation of former facility structures. The activities are summarized in Section 1.4.1 of the RD/RA Workplan.

1.3.2.4 Phase II Engineering Evaluation and Cost Assessment

The on-site soil sampling included the advancement of seven borings on-site. Results indicated that 5 of the 7 borings exceeded 1,500 mg/Kg lead at total depth. Historic slag was encountered at approximately three to four feet which is consistent with the information collected during the Phase I TCR (ENTACT, 1998b. The soil sampling locations are illustrated in Figure 1-3 of the RD/RA Workplan. The on-site sampling indicated that significant lead concentrations, up to 35,000 mg/Kg, remained in on-site soils to a depth of 3 to 4 feet. These areas were either covered with the existing concrete surface or had been excavated and backfilled with 2 feet of clean fill as part of the Phase I TCR. Therefore in areas where the concrete was competent and in uncovered areas that were excavated as part of the Phase I TCR, the potential for further entrainment of airborne lead had been mitigated and was no longer considered a concern (ENTACT, 1998b). However a potential for airborne lead releases did exist in areas where the concrete was compromised. These areas were recommended for repair to mitigate this airborne migration route (ENTACT, 1998b)

A perimeter surface soil survey was conducted adjacent to the fence line along the western, eastern and southern boundaries of the MMI facility property using an XRF instrument, at nineteen locations designated in Figure 1-3. Results of the perimeter lead survey showed lead levels ranging from 931 ppm to 36,587 ppm within the upper 12 to 24 inches of soils, decreasing rapidly with depth. The surficial elevated lead levels currently pose a potential ingestion or inhalation threat, and were recommended for further remedial action (ENTACT, 1998b).

Off-site sampling included the collection of nine off-site surface soil samples along Quigley Avenue. The results showed levels of the average lead concentrations to be below the Superfund residential soil screening level of 400 mg/Kg indicating potential airborne lead impacts from the former MMI facility are minimal. No further action was recommended (ENTACT, 1998b).

Groundwater sampling conducted in 1991 showed total lead concentrations ranging from 0.45 mg/L to 1.35

mg/L, total chromium concentrations ranging from 0.02 mg/L to 1.33 mg/L and lesser concentrations of arsenic and cadmium (CTI, 1991). Groundwater sampling of the three existing monitoring wells during the 1998 EE/CA investigation showed the presence of lead, arsenic, cadmium and chromium at levels that have either remained at, or have declined from, the 1992 sampling results. Groundwater is not used as a source of drinking water within a four-mile radius of the site, with Lake Erie supplying the greater Cleveland area with its drinking water supply. Based on the low concentrations of metals in the groundwater and the lack of any potential downgradient receptors, the groundwater migration pathway was eliminated as a concern (ENTACT, 1998b).

The EE/CA assessment verified that lead was the predominant hazardous constituent of concern at the site, with lesser occurrences of arsenic. Removal action directed at lead exceedences would also address the co-located elevated levels of arsenic. Based on a streamlined risk evaluation, a risk-based remediation goal (RBRG) for lead of 1,000 mg/Kg was established for on-site and off-site perimeter soils (ENTACT, 1998b). Based on the EE/CA results this final removal action has been designed to address the remaining lead impacts associated with former facility operations.

1.3.3 Current Status

Based on the findings of the Phase II EE/CA, an AOC was entered into between the USEPA and the PRP Respondent Group on _____to perform a non-critical removal action outlined in the Statement of Work (SOW) to address remaining lead impacts at the site that are associated with former facility operations. In accordance to the revised Statement of Work (SOW), the following tasks are to be completed as part of this AOC:

- Clear and grub areas requiring excavation of all trees and brush for disposal off-site.

- Demolish above-grade concrete and metal structures remaining on-site after the Phase I TCR demolition activities in accordance to the design specifications. Sized concrete construction debris will either be used as a sub-base material in areas to be covered with the asphalt cover or will be transported off-site disposal as construction debris. All wood, bricks or metal debris that are removed will be disposed of off-site as construction debris.

- Establish a coordinate grid system along the perimeter of the property outside the fence line and in on-property areas where excavation is required.

- Excavate off-property soils along the western, eastern and southern perimeter of the MMI facility, that exceed the RBRG of 1,000 mg/Kg or until historic slag fill material is encountered, whichever comes first. XRF screening technology will be used to guide the depth of the excavations during removal.

- Excavate designated on-property soils that are not under concrete or the proposed asphalt cover (including grids I1, J1 and K1 excavated during the Phase I TCR) that exceed the RBRG of 1,000 mg/Kg or until historic slag fill material is encountered, whichever comes first.

- Conduct confirmatory soil sampling from the excavation floor in grids where the excavation was terminated prior to reaching the historic slag fill material to confirm that all soils that are above the

cleanup level have been excavated and removed.

- Backfill all excavated areas once verified to have met the RBRG or have reached historic slag fill, and grading to promote positive drainage in accordance with the design documents. Backfill for areas not covered by asphalt or concrete will be filled with clean imported fill material that has been approved for use based on analytical results and is suitable to maintain vegetative growth.

- Stabilize excavated soils to meet the applicable LDRs for contaminated soils for lead, and any underlying hazardous constituent (UHC) during waste profiling, to render the material nonhazardous for either use as fill in low areas beneath the proposed asphalt cover or for off-site disposal at an approved Subtitle D facility.

- Conduct verification sampling of treated soils using TCLP lead analysis to verify the material has been rendered non-hazardous for lead prior to either placement in low areas beneath the proposed asphalt cover or for off-site disposal as nonhazardous waste.

- Off-site disposal of all treated soils not used to fill low areas beneath the proposed asphalt cover, including stockpiled soils from the Holmden Properties Removal Action, in accordance with the SOW and the approved design plan.

- Place an asphalt cover over the deteriorated area of the concrete located in southern portion of the site in accordance with the design documents.

- Recondition existing concrete surfaces not under the asphalt cover by sealing any significant cracks and breaks that extend through the concrete surface, followed by encapsulation of the concrete surface, in accordance with the approved design plan.

- Abandon of all existing monitoring wells on site in accordance to applicable State of Ohio regulations (OAC-3745-9-10).

- Remove any existing solid waste including Investigative Derived Waste (IDW) from previous or current removal actions.

- Install a perimeter chain-link fence and three double-swing gates at the completion of the RA to control site access at the site in accordance with the design documents.

- Development of an Operation and Maintenance (O&M) Plan to ensure the integrity of the remedy by maintaining and repairing the concrete and asphalt cover, and the perimeter fencing for a period of thirty (30) years, and as specified in the AOC.

1.4 PROJECT OBJECTIVES AND INTENDED DATA USAGES

The primary objective of the removal action (RA) at the MMI Site is to address the lead-contaminated soils that have been determined to be a threat to human health and the environment. The RA for this site, defined

in the AOC, has been designed to reduce the potential threat to human heath from lead exposure based on the intended future land use for both the site and surrounding areas. The boundaries of the RA include the 4.3-acre site and the adjacent off-site perimeter property as defined in the revised SOW.

The purpose of the data to be generated as part of this RA and covered under this QAPP is to verify that the removal performance standards for all associated RA tasks have been met in areas identified in the revised SOW. These performance standards are discussed in the Performance Standard Verification Plan (Appendix B to the RD/RA Workplan). For this project, the tasks and associated performance standards are detailed in Section 1.3.3.

In addition, sufficient data will be gathered during project activities to verify that the performance standards associated with the short-term implementation of the RA (i.e., air sampling, any necessary wastewater or waste characterization sampling for off-site disposal, sampling of backfill material etc.) as described in the FSAP (Appendix C of the RD/RA Workplan), are met. The list of the RA activities and intended data usage are presented in Section 1, Table QAPP-1.

Data collected as part of the removal action will need to meet the Data Quality Objectives (DQOs) applicable for the end use of the data that was collected. As such, different data uses may require different levels of data quality. DQOs are qualitative and quantitative statements that specify the quality of results required to support decisions made during the project and have been in accordance with the Quality Objectives Interim Guidance Document (EPA QA-G-4).

The three types of DQOs identified for use at the site include the following:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It will be used for field screening and health and safety monitoring at the site, and preliminary comparison to ARARs. This type of data will be used for the X-Ray Fluorescence (XRF) instrument and air monitoring equipment at the site.

- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include laboratory data with quick turnaround times used for screening but without full quality control documentation. This type of data will be used backfill characterization, wastewater characterization, if needed, and waste characterization.

- Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and verification that performance standards have been met. This requires full analytical and data validation procedures in accordance with EPA recognized protocol. This type of data will be used for all confirmatory soil sampling and treatment verification sampling to verify that performance standards have been met.

1.4.1 Project Target Parameters

A summary of the project tasks, the associated sampling parameters and the intended data usage are presented in Section 1, Table QAPP-1. Holding time and preservation required for these samples is presented in Table FSAP-1, Appendix C of the RD/RA Workplan.

Specific tasks are described in the following sections.

1.4.1.1 Excavation of Lead-Impacted Soils

Excavation of site soils will be performed on an estimated 40 sample grids. The XRF field-screening device will be used to measure lead concentrations in soils to guide the lateral and vertical extent of the excavation in each grid. Excavation will proceed until either the RBRG of 1,000 mg/Kg has been met or until historic slag is encountered (maximum depth), whichever comes first. Though soils will be field screened using an X-Ray Fluorescence analyzer during excavation activities, the XRF will NOT be used to verify that performance standards have been met. Utilization of this field-screening device will allow for more expedient decision-making regarding volume of material present requiring excavation, and treatment to render the material nonhazardous. This utilization will increase project efficiency. The XRF analyzer will be calibrated and compared to known standards on at least a daily basis in accordance with the standard operating procedure (SOP) for the XRF as presented in Attachment FSAP-1 of the Field Sampling and Analysis Plan.

If the XRF indicates the performance standard has been met prior to reaching the historic slag fill, a post-excavation confirmatory sample will be collected from the floor of the excavation in that grid to verify that the lead concentration is below 1,000 mg/Kg total lead RBRG. Samples will be collected in the center of each grid and submitted for laboratory analysis of total lead. A detailed discussion of the post-excavation confirmatory sampling methodology is provided in Appendix C, Field Sampling and Analysis Plan of the RD/RA Workplan. If the level of lead in the soil is confirmed by the laboratory to be below the performance standard, no further excavation in the grid will occur and the grid will be backfilled with clean fill material. If the confirmatory sample indicates that the performance standard has not been achieved, additional excavation will be conducted in that grid until either the RBRG has been met or until historic slag is encountered.

1.4.1.2 Stabilization of Lead-Impacted Soils

Treatment is required of excavated soils on-property and along the site perimeter to render the material nonhazardous prior to either filling low areas beneath the asphalt cover or off-site disposal. The soils will be treated using a treatment system and additive blend that has been determined to be effective during the Treatability Study as presented in Appendix E of the RD/RA Workplan. The soils will be treated to meet the nonhazardous criterion of <5.0 mg/L TCLP lead.

The treated soils to be disposed of off-site will be transported to an approved Subtitle D landfill facility. As defined in 40CFR 268.45(c)(1)(C), the treated soils will meet the Land Disposal Restriction (LDR) standard of 10 times the Universal Treatment Standard for the primary hazardous constituent (<7.5 mg/L TCLP lead) and any underlying hazardous constituents (UHCs) that may be identified during the waste profiling. The treated soils will also be less than the hazardous characteristic level for lead (<5.0 mg/L TCLP lead) or any other identified UHC to allow for off-site disposal as nonhazardous waste.

1.4.1.3 Backfilling

Following excavation in areas outside the asphalt or concrete cover, clean imported fill will be used to bring the site back to grade then vegetated. The backfill material will be tested prior to use. Analytical

parameters are listed in Table QAPP-1. The frequency and sampling methodology for backfill sources are presented in Table QAPP-2. Field Sampling and Analysis Plan. Appendix C of the RD/RA Workplan

1.4.1.4 Air Monitoring

During removal activities, air monitoring will be performed for Total Suspended Particulate (TSP) matter for total suspended particulate and total lead particulate to ensure that the performance standard outlined in the SOW and the National Ambient Air Quality Standards are not exceeded. Personal and area air monitoring for lead will also be conducted to ensure worker safety. Air monitoring is also discussed in Section in Section 4.0 of the FSAP (Appendix C of the RD/RA Workplan) and Section 7.0 of the HASP.

1.4.1.5 Waste Characterization

Based on the actual volume of stabilized soils that will need to be placed beneath the cap, some soils may be transported off-site for disposal as nonhazardous waste at an approved Subtitle D landfill facility, in accordance with the Final Design. In accordance to the SOW, and described in Section 1.4.1.2, contaminated soils deemed to be hazardous will be treated to not only meet the LDR standard of 10 times the Universal Treatment Standard (or 7.5 mg/L TCLP lead) as defined in 40CFR 268.45(c)(1)(C), but also to be less than the hazardous characteristic lead level (<5.0 mg/L TCLP lead) to allow for off-site disposal as nonhazardous waste. Therefore contaminated soils requiring treatment will be stabilized to nonhazardous levels (< 5.0 mg/L) using the TCLP test to measure compliance, and shipped off-site for disposal in an approved Subtitle D landfill.

Construction debris associated with demolition of above-ground concrete structures will be pressure-washed and disposed of off-site at an approved facility. Any other investigative-derived waste will be disposed in accordance to all applicable federal and state requirements.

1.4.1.6 Wastewater Characterization

Any bulked decontamination water or water pumped from excavation areas or open pits that is not used for dust control measures will be tested for applicable Northeast Ohio Regional Sewer District (NEORSD) analytical parameters to allow for discharge to the sewer system with approval from the NEORSD.

1.4.2 Field Parameters

During the implementation of the RA, XRF field screening for lead will be conducted to guide the depth of excavations. Other various field-monitoring activities will be conducted to collect information regarding worker health and safety and to evaluate the effectiveness of fugitive dust controls at the site.

Air monitoring will be conducted within the work area and along the perimeter of the work area. The air monitoring locations will be established based on wind and weather data collected on a daily basis. Air monitoring and sampling will be performed as described in the Field Sampling and Analysis Plan (Appendix D of the RD/RA Workplan).

Acceptable limits of field instrument screening errors are presented in Section 8, Table QAPP-8.

1.4.3 Laboratory Parameters

The primary purpose of the RA data collection is to gather sufficient information to verify that the performance standards outlined in the PSVP have been achieved. These standards include the RBRG for total lead in soils of 1,000 mg/Kg or the presence of historic slag, whichever is encountered first, and a treatment standard of <5.0 mg/L TCLP lead to render the excavated material nonhazardous waste. A summary of the laboratory parameters for each task and the associated QC samples are provided in Section 3.0, Table QAPP-2.

The detailed design of each sampling program, procedures and methods that will be used to acquire the data for air and soils is presented in Appendix C, Field Sampling and Analysis Plan of the RD/RA Workplan.

Acceptable limits on decision errors used to establish the sampling results are provided in Attachment QAPP-C.

1.5 SAMPLE NETWORK DESIGN AND RATIONALE

Total lead analyses will be used as the indicator for contaminant removal and surficial and subsurface soils at the site. Previous sample results from this site, coupled with experience from similar sites, indicate that not only is lead the predominant contaminant, it is a good general indicator of removal of other metals that may be co-located at the site.

Air monitoring parameters were chosen based on known contaminants and the nature of the work. Since excavation activities will be taking place, airborne contaminants are the major concern.

Table QAPP-2 in Section 3.0 of the QAPP summarizes the project samples to be taken by task, the matrix to be analyzed, the parameters to be analyzed, and the frequency of collection. Project specific reporting limits are presented in Section 7.0, Tables QAPP-3 through QAPP-7.

1.6 PROJECT SCHEDULE

The removal activities as described in the RD/RA Workplan will require approximately six weeks to complete. Refer to the Figure 3 of the RD/ RA Workplan for a detailed schedule of specific tasks.

TABLE QAPP-1
Intended Data Usage

ACTIVITY	DESCRIPTION	PARAMETERS	INTENDED DATA USAGE
Perimeter Air Monitoring	Air	Lead , TSP	Health monitoring Monitor fugitive lead and particulate emissions on-site and perimeter
Lead-Impacted Soils	Soil	XRF Lead Total Lead	Determine the vertical and horizontal extent of lead impacted soils until either the RBRG of 1,000 mg/Kg lead is met or until historic slag is encountered, whichever comes first.
Excavated soil treatment	Stabilized lead-impacted soils	TCLP Lead	Verify the treatment standards for contaminated lead-impacted soil (7.5 mg/L) are met and ensure material is rendered nonhazardous (< 5.0 mg/L) for on-site placement and consolidation.
Backfill Material Sampling	Soil (Imported Fill)	8 RCRA Metals VOCs Pesticides PCBs TPH	Characterize imported fill material prior to use as backfill in excavated areas.
Waste Characterization Sampling for Disposal	Stabilized Soils	Waste Profile Parameters requested by Landfill	Characterize waste for off-site disposal to a nonhazardous Subtitle D Landfill facility
Wastewater Characterization Sampling for Disposal, if necessary	Bulked Wastewater	NEORD's Discharge Parameter List	Characterize wastewater to determine if it can be discharged to the city sewer system.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 PROJECT ORGANIZATIONAL CHART

Figure 2-1 of the RD/RA Workplan illustrates the lines of authority of the Removal Action Management Team for overseeing and implementing the required removal activities at the MMI site in Cleveland, Ohio. ENTACT's assigned management team may change during implementation of the RA. If there is a change in personnel of ENTACT's management team, the modification will be communicated to US EPA's RPM and the Project Coordinator.

2.2 MANAGEMENT RESPONSIBILITIES

USEPA CERCLA Project Manager, Gwen Massenberg

The USEPA CERCLA Project Manager has the overall responsibility for all phases of the Remedial Action Workplan.

Project Coordinator, Terry Casey, Efficasey Environmental LLC

The Project Coordinator's prime responsibility will be to ensure proper coordination among various project stakeholders. These stakeholders include the USEPA, OEPA, City of Cleveland, NOLTCO, Bredt & Zanick, LLC, the Project Manager, and the Respondents to the Order.

Project Manager, Mike Stoub, ENTACT.

Mr. Stoub will have the overall responsibility for ensuring that the remedial activities are implemented and completed in accordance with the AOC, revised Statement of Work, the U.S. EPA-approved RD/RA Workplan and federal, state, and local regulations. Specific responsibilities of the Project Manager will include, but not be limited to, the following:

- Providing personnel and equipment for remedial activities;
- Ensuring the RA is completed with the approved schedule;
- Ensuring effective communications between the Project Coordinator and U.S. EPA's RPM;
- Ensure that all documents and reports that ENTACT is required to generate meets the requirements of the approved workplan;
- Communicate any request for modifications to the approved workplan to the Project Coordinator and U.S. EPA; and
- Promptly notifying the Project Coordinator and U.S. EPA's RPM in the event of unforeseen field conditions and/or problems are encountered.

Field Project Manager, Bob Ainslie, ENTACT, Inc.

Mr. Ainslie will work with the Project Manager in overseeing the removal activities at the site and ensuring that the site activities are implemented and completed in accordance with the AOC, Statement of Work, the

U.S. EPA-approved RA Workplan and federal, state, and local regulations. Specific responsibilities of the Project Coordinator will include, but not be limited to, the following:

- Providing the Project Manager and USEPA's RPM the names and qualifications of contracted laboratory, disposal facilities, recycling facilities, and transporters used to implement the RA;
- Ensuring that ENTACT's associates perform their designated duties in accordance with the Health and Safety Plan;
- Ensuring required quality assurance/quality control procedures are properly implemented and documented;
- Notifying appropriate personnel identified in the Health & Safety Plan in the event of spills or air releases that exceed criteria;
- Working with the Project manager in ensuring the RA is completed following the approved schedule;
- Notifying appropriate personnel identified in the Health & Safety Plan in the event of spills or air releases that exceed criteria;
- Communicating any request for modifications to the approved workplan to the Project Coordinator and USEPA; and
- Promptly notifying the Project Manager and the USEPA's RPM in the event of any unforeseen field conditions and/or problems that are encountered.

Regulatory/Technical Leads. Pat Vojack, P.G., Mark Waxali P.E., ENTACT & Associates LLC

Ms. Vojack and Mr. Waxali will provide regulatory, technical and engineering support to the Project Manager in ensuring that the site activities are implemented and completed in accordance with the AOC, SOW, the U.S. EPA-approved RA Workplan and federal, state, and local regulations. They will also provide technical support to the Field Manager in the areas of wastewater management and treatment, solid and hazardous waste management, air and groundwater monitoring, and any other technical design requirements for the RA.

Corporate Health and Safety Director. Mr. Jonathan Patlak, ENTACT & Associates LLC.

The Corporate Health and Safety Officer will coordinate and provide oversight for the Health and Safety issues at the site. He will be responsible for conducting the Health and Safety Orientation meeting before the RA is implemented. He will review weekly health and safety updates from the site and conduct several inspections at the site during the RA.

Management Control Process

The ENTACT Project Manager has overall responsibility for successfully completing the remedial action at the site. This includes safely completing technical Statement of Work items, fulfilling contractual obligations, compliance with the approved workplan, and meeting all or exceeding the established project schedule and budget. The Project Manager will accomplish these objectives by monitoring the work progress, reviewing and planning each project task with experienced technical staff and the Field Project Manager, and ensuring the appropriate and sufficient resources are available to the Field Project Manager and the On-Site QA/QC Officer.

The Project Manager will receive daily progress reports from site personnel appraising him of the status of planned, ongoing, and completed work, including QA/QC performance and health and safety, site-specific issues. In addition, the Project Manager will be apprised of any potential problems and recommendations for solutions and/or corrective action.

Qualifications and experience of ENTACT's Management Team are provided in Attachment QAPP-A of the QAPP.

2.3 QUALITY ASSURANCE RESPONSIBILITIES

US EPA Region 5 Superfund's Quality Assurance Coordinator

U.S. EPA Superfund Quality Assurance Reviewer has the responsibility to review and approve all Quality Assurance Project Plans. In addition, the U.S. EPA Quality Assurance Coordinator is responsible for conducting external performance and system audits of the laboratory and evaluating analytical field and laboratory procedures.

Quality Assurance Manager, Patricia Vojack, P.G., ENTACT & Associates LLC

The ENTACT QA Manager will be responsible for ensuring that all ENTACT procedures for this project are being followed. In addition, the ENTACT QA Manager will be responsible for the data validation of all sample results from the analytical laboratory. Specific responsibilities will include, but are not limited to, the following activities:

- Ensuring required quality controlled testing is performed and documented and the results are provided to the ENTACT's project management team, the Project Manager, and U.S. EPA in accordance with the requirements of the approved workplan;
- Providing oversight and direction to the on-site quality assurance official; and,
- Providing assistance in the modification of QA methodology or implementation based on conditions encountered during the remedial activities; if different than specified in the approved QAA.

On-Site QA Officer, Field Engineer, ENTACT & Associates LLC.

The on-site QA officer will be responsible for performing required quality control testing at the site. The on-site Quality Control Officer will operate independently of ENTACT's Project Manager and Field Project Manager. The QA/QC Officer will communicate any QA/QC issues related to the site to the Project Manager. The QA/QC officer will have the authority to correct and implement additional measures to assure compliance with the approved workplan, including the QAPP. Specific responsibilities will include:

- Adhere to the approved QAPP;
- Document any deviations to the plan with a justification for the deviations, and if necessary appropriate notification in accordance with the approved workplan;
- Secure necessary sampling tools, bottles, packaging/shipping supplies, chain-of custody documents, etc. in accordance with the approve workplan;
- Collect or direct the collection and ship samples at the frequencies and for laboratory analysis parameters

specified in the QAPP:

- Document the location, time, and date of all samples that are collected and shipped to the laboratory;
- Interface with the superintendents such that the sample collection is coordinated with the general progression of the work;
- Notify the project manager, project coordinator and the U.S. EPA of any sampling activities associated with the implementation of the approved workplan; and
- Obtain analytical results and reporting the data to the Project Manager, Project Coordinator, and U.S. EPA's RPM.

2.4 LABORATORY RESPONSIBILITIES

The laboratories which will be performing the sample analysis for this project, except for air samples, is:

GeoAnaltyical, Inc.
9263 Ravenna Road
Twinsburg, OH 44087
Phone (330) 963-6990

The laboratory performing the air monitoring analysis is:

GeoAnalytical Project Manager, Amy Onest

The GeoAnalytical Project Manager will report directly to the ENTACT QC Manager and will be responsible for ensuring that all resources of the laboratory are available on an as required basis. He is also responsible for the overview of final analytical reports.

GeoAnalytical Quality Assurance Officer, Terrence M. Harper

The Quality Assurance Officer has the overall responsibility for data after it leaves the laboratory. The GeoAnalytical QA Officer will communicate data issues through the GeoAnalytical Project Manager. In addition, the GeoAnalytical QA Officer will overview laboratory quality assurance and QA documentation, conduct detailed data review, determine whether to implement corrective action, and define appropriate laboratory procedures.

GeoAnaltyical Sample Custodian

The GeoAnalytical Sample Custodian will report to the GeoAnalytical Project Manager. The GeoAnalytical Sample Custodian responsibilities will include: receiving, recording and inspecting the incoming samples; verifying chain-of-custody and its accuracy; notifying laboratory manager and supervisor of sample receipt and inspection; assigning a unique identification number and customer number, and entering each into the sample receiving log; transfer samples to the appropriate lab section.

GeoAnalytical Technical Staff

The GeoAnalytical Technical Staff will be responsible for sample analysis and identification of corrective

actions.

Qualifications and experience of GeoAnaltyical Inc. QA/QC Management Team are provided in Attachment QAPP-A of the QAPP.

3.0 QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results, which are legally defensible in a court of law. The purpose of implementing these procedures is to assess the data generated for accuracy, precision, representativeness, completeness, and comparability for both the laboratory analytical program and field sample collection activities. The primary goal of the program is to ensure that the data generated are representative of environmental conditions at the site. To obtain this goal, a combination of statistical procedures and qualitative evaluations will be used to check the quality of the data.

Precision, accuracy, representativeness, completeness, and comparability (PARCC) will be computed in the manner described in the following paragraphs. A qualitative assessment of PARCC factors will be made and will be documented. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 PRECISION

The precision of laboratory results and field sampling efforts will be evaluated by examining laboratory and field QC sample results. Analytical precision will be evaluated for analytical methods by comparing the QC criteria stipulated in the standard operating procedures to the results from laboratory matrix spike/matrix spike duplicate samples and field duplicate samples.

3.1.1 Definition

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, usually expressed in terms of the standard deviation.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 investigative analytical samples.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) for replicate samples. The equations to be used for precision in this project can be found in Section 12 of this QAPP. Precision control limits are given in tables in Section 8.

3.2 ACCURACY

The accuracy of the analytical data will be assessed by examining the results obtained from the analysis of sample blanks, duplicate samples, laboratory matrix spike/matrix spike duplicate samples, and method

required laboratory QA/QC samples. One equipment blank will be prepared and documented for every 10 investigative samples. One matrix spike, and one matrix spike duplicate will be analyzed for every 20 investigative samples. Data will be qualified in accordance with the appropriate EPA functional guidelines for evaluating data if either field QC blanks or laboratory QC blanks indicate that the accuracy or precision of analytical results is compromised.

3.2.1 Definition

Accuracy is the degree of agreement of a measurement with an accepted reference or true value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field blanks and adherence to all sample handling, preservation, and holding times.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or standard reference materials (SRM) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12 of this QAPP. Accuracy control limits are provided in Attachment QAPP-C of the QAPP.

3.3 COMPLETENESS

3.3.1 *Definition*

Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected and required to meet the project data goals.

3.3.2 Field Completeness Objectives

Field completeness is the measurement of the amount of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 90 percent. Residential well sampling completeness will be 100%. This completeness goal is considered adequate to meet the data quality objectives for this site based on prior consideration of PARCC parameters, the sampling design plans, and data collection activities proposed for each medium. In developing the sampling design plan, critical data points were carefully considered and identified to help ensure comparability of data. The equation for completeness is presented in Section 12 of this QAPP.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent

completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 90 percent. Residential well sampling completeness will be 100%. The laboratory equation for completeness is presented in Section 12 of this QAPP.

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent environmental conditions and parameter variations at a sampling location. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by assuring that sampling locations are properly selected and a sufficient number of investigative samples are collected.

3.4.1 Definition

Representativeness is the selection of analytical methods and sampling protocols and locations such that results are representative of the media being sampled and conditions being measured.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Field Sampling and Analysis Plan (FSAP) is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample-holding times, and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions. During the development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting, and constraints inherent to the RA Workplan. The rationale of the sampling network is discussed in detail in the RA Workplan and Section 4 of this QAPP.

3.5 COMPARABILITY

Comparability cannot be ensured through use of standard methods and protocols alone. In order to compare data, various important elements will be considered. During this project, three elements will be evaluated for data comparability. These three elements include analytical methods, quality of data, and sampling design. If after the initial evaluation, data do not appear comparable, the QA Manager will attempt to identify other components possibly affecting comparability, including but not limited to field conditions, sampling protocols, and the occurrence of true data anomalies.

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared to another.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSAP is followed and that proper sampling techniques are used.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Similar QA objectives will be used throughout the project to ensure comparability.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Field blank, duplicate, and matrix spike samples will be analyzed to assess the quality of data resulting from the field sampling and analytical programs.

3.6.1 Field Data

Field blanks, for water samples, consisting of distilled water used to rinse decontaminated sampling equipment will be submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the facility that may cause sample contamination. Field blanks will be collected at a frequency of 1 per 10 water samples. Also, one field blank will be prepared for every 10 investigative samples if reusable sampling equipment is used. Sampling procedures are specified in the sampling portion of the RA Workplan and Section 4 of this QAPP.

The precision and accuracy of field measurements (such as pH, conductivity, etc) are discussed in Section 8.1 of the QAPP and listed in Table QAPP-8.

3.6.2 Laboratory Data

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. One MS/MSD will be analyzed for every 20 or fewer investigative samples per sample matrix.

TABLE QAPP-2

SUMMARY TABLE OF GRID SAMPLING AND ANALYSIS PROGRAM FOR THE REMOVAL ACTION MASTER METALS, INC. SITE, CLEVELAND, OHIO

Sample Type	Analysis Parameters	Investigative Samples			Field Quality Control Samples									Totals
					Field Duplicates			Field Blanks[4]			MS/MSD[1]			
		No	Freq	Total	No	Freq	Total	No.	Freq	Total	No.	Freq	Total	Total
Post Excavation Sampling	Laboratory ---- Total Lead	40	1	40	4	1	4	4	1	4	--	--	--	48
	Field ---- XRF Lead	160	1	160	--	--	--	--	--	--	--	--	--	160
Treatment Confirmation Sampling[5]	Laboratory ---- TCLP Lead	20	1	20	--	--	--	--	--	--	--	--	--	220
Backfill Testing[3]	Laboratory --- RCRA Metals[2]	2	1	2	--	--	--	--	--	--	--	--	--	5
	Laboratory --- VOCs	2	1	2	--	--	--	--	--	--	--	--	--	5
	Laboratory --- TPH[8]	2	1	2	--	--	--	--	--	--	--	--	--	5
	Laboratory --- Pesticides PCBs	2	1	2	--	--	--	--	--	--	--	--	--	5
Waste Characterization Sampling[6]	Laboratory ---- TCLP Lead	10	1	10	--	--	--	--	--	--	--	--	--	10
Wastewater Sampling[7]	NEORSD Discharge Parameters	10	1	10	--	--	--	--	--	--	--	--	--	10
Air Monitoring	TSP-total lead Respirable Dust	Refer to FSAP, Table FSAP-1 for air sampling frequencies and type												

NOTES:

[1] For metals analysis, no extra sample volume is required. MS/MSD will be performed at a rate of one per twenty investigative samples analyzed by the laboratory

[2] RCRA Metals – arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury

[3] Estimate of one sample to be collected for every 10,000 yards of material per source

[4] Field blank samples are only required if re-usable sampling equipment is used (i.e. stainless steel bowls or trowels)

[5] Assumes analysis of one treatment sample for every 250 cubic yards for the first 1,000 yards and every 500 yards thereafter. Assumes 1,800 to 3,600 cubic yards of material to be treated

[6] If actual volume necessitates some off-site disposal as nonhazardous special waste

[7] Bulked wastewater not used for dust suppression, will be sampled for NEORSD discharge parameters for discharge to city sewer system

[8] If the TPH results exceed the petroleum faction residual saturation concentrations listed in Table 1 under Ohio Rule 3745-300-8 (8 to 40 mg/Kg for glacial till or silty clay soils), the fill will then be analyzed for SVOC compounds

4.0 SAMPLING PROCEDURES

This section summarizes the sample documentation, sampling procedures and the QC sample preparation requirements associated with the RA tasks. A detailed discussion of the sampling procedures is presented in the Field Sampling and Analysis Plan (FSAP), presented in Appendix C of the Final RD/RA Workplan, revision 1.

Details on holding times, sample preservation and bottle requirements are presented in the FSAP, Table FSAP-1. The holding time for pesticides/PCBs listed in Table FSAP-1 reflects the post-extraction holding time of 40 days. However, pesticide and PCB samples also have a pre-extraction holding time requirement of fourteen days

4.1 SAMPLE DOCUMENTATION/IDENTIFICATION

The designated sample identification system is discussed in detail in Section 2.2 of the FSAP and summarized below:

Samples Type	Identification System
Air Samples:	
TSP High Volume Samples	TSP-Unit=-001
Personal Area Low Volume Samples	PAS-Unit=-001
Soil Samples:	
X-Ray Fluorescence Field Screening	X-01-1
Post-Excavation Confirmatory Samples	V-01-2.0'
Treated Material-Confirmation (TCLP) Samples	TS-001
Imported Backfill Samples	BF-001
Waste Characterization Samples:	
Solid Waste (stabilized soils, if needed)	W-001
Wastewater	WW-001
Quality Control Samples:	
Field Duplicate Samples for Soil, Treated Material	FD-001
Field Rinsate Blanks	FB-001

Sample identification documents will be carefully prepared to maintain identification and chain-of-custody records, and to control sample disposition. Components of the field documentation procedures include the use of field logbooks, sample labels, and the chain-of-custody forms. Original data recorded in field logbooks, chain-of-custody records, and other forms will be written in waterproof ink. None of these documents will be altered, destroyed, or discarded, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on a document assigned to one individual, that individual will make the corrections by making a line through the error, entering the correct information, and initialing and dating the change. Samples and documentation will be maintained and handled by as few people as possible.

4.2 SAMPLE COLLECTION/PREPARATION PROCEDURES

Sample collection methodology is described in detail in Section 3.0 and Section 4.0 (air) of the FSAP and summarized in the following subsections.

4.2.1 XRF Field Screening

The XRF or Lead analyzer will be used on site during excavation activity only as a screening tool to assess the total lead concentration in soils but will not be used to verify that performance standards have been met. The area to be screened will be prepared by scraping the top layer of potentially cross-contaminated soil with a stainless steel trowel or plastic scoop and smoothing the area flat so as not to pierce the Mylar window of the probe. The in-situ measurement will be made by placing the XRF probe on a flat area of the ground surface and scanning the soil surface.

The particular instrument to be used is the Spectrace 9000 Portable XRF Analyzer or comparable Lead Analyzer. This device utilizes a probe, which consists of a sealed aluminum enclosure containing a high-resolution mercuric iodide detector and three radioisotope x-ray excitation sources, Fe-55, Cd-109 and Am-241. The Spectrace 9000 utilizes a fundamental parameter XRF calibration derived from theoretical considerations. The menu-driven software supports multiple XRF calibrations called "Applications". Each Application is a complete analysis configuration including elements to be measured, interfering elements in the sample, and a set of fundamental parameter calibration coefficients.

The Standard Operating Procedure (SOP) for the XRF instrument is included in Attachment FSAP-1 of the FSAP. The XRF field screening data may be tabulated for presentation in the final report, but is not to be used to confirm that the performance standards have been met.

4.2.2 Confirmatory Sampling

If excavation is terminated in a grid prior to reaching the historic slag (maximum depth), a confirmatory sample will need to be collected to verify that the RBRG of 1,000 mg/Kg has been met for that grid. The sample will be collected as a grab sample using the following equipment and supplies:

- Stainless steel or plastic disposable scoops or trowels
- Sample containers and plastic bags

- Field notebook
- Chain-of-custody form
- Decontamination supplies (Decontamination may be conducted at the sample location staging area or the main decontamination area)

Field notes will be recorded for each sample taken and will include sample identification, soil description (color, type, and foreign material) and any other pertinent observations relating to the sample or site conditions at the time of sampling.

The sample will be obtained by excavating soil from a depth of approximately 0 to 3 inches below excavated ground surface using either a decontaminated stainless steel trowel or a clean plastic disposable scoop. An additional quantity of sample material will be obtained at 10 percent of the sample locations for a field duplicate and will be shipped to the laboratory. The sample material will be stirred in a Ziploc plastic bag or stainless steel bowl to homogenize, then split in half to make each sample portion. Replicate/split samples will be also be provided to the EPA upon request.

4.2.3 Backfill Characterization Sampling

Backfill samples will be collected as single grab samples from the representative material for each source and for each type of material prior to shipment to the site to ensure the material meets both the chemical and geotechnical requirements and then at increments of one sample per 10,000 tons. A change in source location will require the collection of a new initial sample round for each type and source used. No field duplicates, field blanks or MS/MSD samples will be collected for the backfill samples.

The samples will be submitted to the designated Project Laboratory, GeoAnalytical, Inc.Twionsburg, Ohio, for chemical analysis of the applicable parameters using DQO Screening Level in accordance with the QAPP. DQO Screening Level 2 will provides the appropriate level of quality assurance data for fill material characterization. Samples will also be submitted either to the selected geotechnical testing laboratory or will be tested by the source supplier with certification provided to ENTACT for review and approval.

4.2.4 Waste Characterization Sampling

Waste characterization samples will be collected as grab samples from representative material for the parameters listed in Table 1. The frequency of collection is dependent on landfill requirements as well on the RCRA classification of the material. Waste characterization sampling will follow the procedures outlined in the FSAP, Section 5.2.2. No field duplicates, field blanks or MS/MSD samples will be collected for the waste samples.

The samples will be submitted to the designated Project Laboratory, Geo Analtyical, Twinsburg, Ohio, for off-site laboratory analysis of the applicable parameters using DQO Screening Level in accordance with the QAPP. DQO Screening Level typically provides the appropriate level of quality assurance data for waste characterization.

4.2.5 Air Sampling

Two types of air samples will be collected at this site. TSP samples will be collected to determine the total quantity of dust in the air that can be entrained in the respiratory system and the amount of lead particles in the air. Personal / area air samples will be collected in order to monitor worker safety conditions as specified in the HASP. The units will be calibrated in accordance with the manufacturer recommendations.

Personal / area air samples will be obtained for personnel and areas by using battery powered Gilian HFS 513 Hi Flow Samplers or equivalent with 37 mm mixed cellulose ester filters. Personal air samples will be taken from the breathing zone of the workers. On-site area samples will be taken in areas where one could reasonably expect elevated airborne lead levels to occur during work activities. Each pump will be calibrated before and after each use using a primary standard (rising soap film). If a variation is found in the flow rate established during the pre and post sampling calibration, the lower, more conservative flow rate will be used and all volume calculations will be based upon the lower flow rate. The flow rate of all pumps will be between 2.0 and 4.0 liters per minute.

One lot blank will be provided to the laboratory per box of filters. No additional QC samples are required for air sampling.

The Standard Operating Procedures for the Total Suspended Particulate (TSP) matter, and Personal / Area Air samplers are provided in Attachments FSAP-2, and FSAP-3 of the Field Sampling and Analysis Plan.

4.3 FIELD QC PROCEDURES

Field duplicate will be collected for confirmatory soil samples and treatment verification samples at a rate of one duplicate for every ten investigative samples collected. At the designated sample location where a duplicate sample will be collected, an ample volume of material will be placed in a Ziploc plastic bag or stainless steel bowl and thoroughly homogenized prior to filling the sample jars. The field duplicate sample will be blind labeled as FD-001 and continue sequentially from 001 with the associated investigative sample recorded in the logbook.

If reusable-sampling equipment is used, (i.e. stainless steel bowl and/or trowel), a field blank sample will be prepared at a rate of one rinsate sample for every 10 investigative samples taken by pouring distilled water over the decontaminated sampling equipment.

MS/MSD samples will be performed at a rate of one for every 20 investigative samples analyzed by the laboratory. No extra sample volume is required for the MS/MSD samples for metals. The MS/MSD will be performed at a rate of one per twenty investigative samples.

4.4 SAMPLE CONTAINERS, PRESERVATIVES AND VOLUME REQUIREMENTS

Confirmatory soil samples and treatment verification samples will be placed into clean plastic or glass 2- and 4-ounce containers for soil samples and 8-ounce containers for TCLP lead analysis. Sample jars will

be supplied by a vendor or laboratory and will be certified clean. There are no preservatives required for either analyses and the container should be completely filled. The container will be labeled with the sample identification number, date and time of sampling and the initials of the sampler. The sample container will be placed in a sealed plastic bag for transportation to the laboratory. The designated laboratory will provide a daily courier service during remedial activities to allow for an expedited analytical turn-around time. If samples must be transported by means of commercial transportation, the samples will be placed in a cooler, packaged in a manner to prevent shifting and breakage in transit, and a custody seal will be placed on the cooler housing the samples such that any tampering with the cooler will be evident by the seal. No ice is required for metal parameters. Sample labels and custody seals are presented in Attachment QAPP-D.

Backfill or waste profile samples that include multiple parameters will be placed into the appropriate container specified in Table FSAP-1 of the FSAP. The volatile organic compound sample will be collected first and placed directly into the sample container to minimize any loss of volatile compounds, with no mixing or homogenizing the soils to prevent loss of potential volatiles contaminants

Sample containers and preservatives are not required for the XRF screening samples. If it is impractical to obtain an in-situ sample, then clean ziplock bags can be used as sample containers. These bags will be labeled to identify the sample identification code, date, time, and sampler's initials.

Air sample filters will be supplied by the laboratory. The sample filters will not be open, left out or tampered with prior to sampling. There are no preservatives required for lead or PM10 analysis.

4.5 SAMPLE CUSTODY

A Chain-of-Custody (COC) form will be filled out at the time of sampling. Information to be recorded on the COC includes sample identification, sample description, name(s) of sampler(s), and requested analyses. The COC will be placed in a sealed plastic bag for protection and will accompany the associated samples to the laboratory. Any time the sample custodian changes, the person relinquishing the samples shall sign the COC and note the date and time of transfer. The person receiving the samples shall also sign the COC and note the date and time of transfer. An example GeoAnalytical COC is located in Attachment QAPP-D of the QAPP.

4.6 DECONTAMINATION PROCEDURES

All re-usable sampling equipment will be decontaminated utilizing a triple rinse procedure. During this procedure, the sampling equipment is scrubbed in a potable water/detergent wash (gross rinse), rinsed in potable water (intermediate rinse), and rinsed with distilled water (final rinse). All three decontamination fluids are changed as needed to ensure proper decontamination; however, to conserve the quantity of waste generated, ENTACT will downgrade the three phase fluids. For example, the final phase fluids are downgraded to intermediate fluids, intermediate fluids are downgraded to gross fluids, gross fluids are collected in a DOT approved container, and fresh distilled water is placed in the final phase. This method minimizes waste and ensures that the final phase fluids are clean. Spent decontamination fluids will be collected throughout the project for proper disposal at an authorized treatment facility.

After decontamination, the sampling equipment will be dried with disposable towels and stored in plastic sampling tool boxes between sampling events. All decontaminated equipment within the sampling tool box will be placed in individual plastic bags or wrapped in disposable towels. The sampling tool boxes will also be decontaminated weekly to ensure cleanliness. All trash and PPE generated during sampling will be placed in designated disposal containers for such items.

4.7 SAMPLE PACKAGING AND SHIPMENT PROCEDURES

Sample containers will be laboratory prepared and shipped in sealed containers to assure that they remain clean. Sample containers will be selected to ensure compatibility with the media being collected, preserve sample integrity, and minimize breakage during transportation. Sample labels will be filled out at the time of sampling and will be affixed to each container to identify sample number, sampler's name, date and time of collection, location of sampling point, and project identification data.

After the containers for a given sampling location have been filled out, they will be placed in plastic Ziplock storage bags, on ice (for VOC, SOC and pesticide/PCB samples only), in an insulated cooler, to be delivered to the analytical laboratory. Each sample container will be secured in packing material, as appropriate, for shipment to the designated laboratory. The insulated cooler lid will be taped closed and sealed to avoid the entrance of contaminants into the cooler and to avoid leaking from the cooler. Shipment of samples to the laboratory will take place on the same day as collection. The Chain-of-Custody form will be enclosed in a sealed plastic bag and adhered inside the sealed cooler. If the samples are sent by common carrier, a bill of lading will be used to document the custody of the sample while in transit. Commercial carriers are not required to sign the COC forms as long as the forms are sealed inside the cooler.

5.0 CUSTODY PROCEDURES

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all original laboratory reports, are maintained under document control in a secure area.

A sample or evidence file is under one's custody if:

- the item is in actual possession of a person; or
- the item is in the view of the person after being in actual possession of the person; or
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

5.1 FIELD CUSTODY PROCEDURES

Sample identification documents will be carefully prepared to maintain identification and chain-of-custody records and to control sample disposition. Components of the field documentation procedures include the use of field logbooks, sample labels, and the chain-of-custody forms. Original data recorded in field logbooks, chain-of-custody records, and other forms will be written in waterproof ink. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

5.1.1 Field Logbook Records

A field log of daily activities will be used to record sampling activities on a daily basis. This book will be bound and have consecutively numbered pages. Entries in the field logbook will be made in ink and will include: the name of the author; date and time of entry; location of activity; names and affiliations of personnel on site; sample collection or measurement methods; number of samples collected; daily weather report; sample identification numbers; field observation and comments; sampling depth increment for soils; field measurements; locations of photographs; and any deviations from the sampling plan. Each logbook will be assigned a project specific document number. The field log book will be stored in the job trailer when it is not in use.

5.1.2 Sample Labels

Sample labels are necessary to prevent misidentification of samples. Preprinted labels will be provided prior to the sampling activities. Each label will contain space for the following information: name of site, sample identification, date and time of sample collection, media sampled, name of sampler, preservatives, and types of analyses to be performed. Example of custody seal and label is provided in Attachment QAPP-D of the QAPP.

5.1.3 Chain-of-Custody Records

A Chain-of-Custody (COC) form will be completed to record the custody of every sample collected. A COC form will accompany every shipment of samples to the analytical laboratory in order to establish the documentation necessary to trace sample possession from the time of sample collection through sample analysis.

The sample portion of the COC form will include the following:

- Project number, name and location;
- Sample identification;
- Name of Project Manager, Sampler, and Recorder;
- Sampling information (sampling area, depth, media type, type of sample, date and time of collection, etc.)
- Analysis to be performed;
- Preservatives used, if any; and
- Signatures of persons involved in the COC possession, including dates.

When a Chain-of-Custody form is filled out, one page of the three-part form is retained and placed in a file at the on-site office. The other two parts of the form accompany the sample to the laboratory. One of those pages is retained by the laboratory and the other is returned with the sample result report. When the sample report is received, it is cross-checked with the COC file record and both COC pages and the laboratory report are placed in a file in fireproof storage at the on-site office. The analytical result is also entered into a computer database consisting of a comprehensive list of all samples taken at the site and the analytical results.

5.2 LABORATORY CUSTODY PROCEDURES

Samples, which are delivered by clients or received by courier, are placed in a secure Sample Control Area immediately upon delivery. Coolers containing samples are unpacked within ½ hour of receipt or placed in the walk-in cooler until unpacked. The COC accompanying the samples will be signed by the Sample Custodian or their designee at the time of delivery by the client, or in the case of courier delivery, where the COC is sealed up inside of the cooler, at the time of unpacking.

At the time of arrival and/or unpacking, coolers will be inspected for evidence of damage. They will be unpacked carefully and samples will be organized on the lab bench in numerical order or by sample sets and assigned a laboratory job number. The condition of both shipping containers and sample containers will be recorded on the internal COC form.

Information on the COC shipped with samples will be verified and recorded as to agreement or non-agreement. Labels will be checked for notation of proper preservation. If there is an apparent non-agreement in the document or incorrect preservation noted, the apparent problem will be recorded and the ENTACT Project Manager notified. The samples will then be marked or labeled with laboratory sample numbers. Laboratory project numbers are assigned serially, with each sample numbered as a subset of the project number. Finally, samples will be placed in appropriate storage and/or secure areas.

5.3 FINAL EVIDENCE FILES

The final evidence file will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP. ENTACT is the custodian of the evidence file and maintains the contents of the evidence files for the MMI removal action, including all relevant reports, records, logs, field notes, pictures, and data reviews in a secured, limited access area under the custody of the ENTACT Project Manager.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

Procedures described in this section pertain to the calibration, maintenance, and operation of equipment and instrumentation to be used during the implementation of the remedial action. A variety of instruments, equipment, and sampling tools will be used to collect data and samples to monitor site conditions. Proper calibration, maintenance, and use of instruments and equipment is imperative to ensure the quality of all data collected. A record of calibration and maintenance activities is important to provide legally dependable data.

Instruments and equipment used to gather, generate or measure environmental and physical testing data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility are consistent with the manufacturer's specifications.

6.1 FIELD INSTRUMENT CALIBRATION

All instruments and equipment purchased or used for the MMI removal action will be inspected to ensure that the item meets and performs to manufacturer's specifications and project specifications. Instruments meeting these requirements are issued to a field technician trained in instrument operation and made available for site use. All field equipment will be calibrated in accordance with the specific field SOPs located in Attachment QAPP-C of the QAPP and in Attachments FSAP-A, FSAP-B, and FSAP-C of the Field Sampling and Analysis Plan. All air samplers will be calibrated in accordance with manufacturer recommendations.

The XRF will be calibrated with the manufacturer's standards and three site-specific standards. Each standard and sample reading will be taken in triplicate and averaged. To check the initial calibration, the middle calibration standard will be rechecked after every twenty samples. A record of the instrument calibration will be maintained in a bound field notebook and these records will be subject to a QA audit. Information recorded will include the following:

- Date of calibration
- All data pertaining to the calibration procedures
- Initials of analyst performing calibration
- Adjustments made to equipment prior to and following calibration; and
- Record of equipment failure

Field instruments that will be used during this project include an X-Ray Fluorescence Analyzer, or comparable Lead Analyzer, TSP and personal/area air samplers.

Any items found to be inoperable will be taken out of use and a note stating the time and date of this action will be made in the calibration logs. The reason for equipment failure and the time and date of its return to service will also be noted in the logbook. Records produced shall be reviewed, maintained, and filed by the field operators. The ENTACT Project Manager will audit these records to verify complete adherence to these procedures.

6.2 LABORATORY INSTRUMENT CALIBRATION

All laboratory instrument calibration procedures can be found in the attached SOPs (Attachment QAPP-B).

7.0 ANALYTICAL AND MEASUREMENT PROCEDURES

The laboratory that will be performing all sample analysis for this project, except for air samples, is:

GeoAnalytical Inc.
9263 Ravenna Road
Twinsburg, Ohio
Phone: (330) 963-6990

Laboratory accreditations and certifications are presented in Attachment QAPP-E.

The laboratory that will be performing air analyses for this project is:

Pace Analytical Services, Inc.
7726 Moller Road
Indianapolis IN 46268
Phone: (317) 875-5894

Complete list of analytical parameters, methods, matrices, holding times and preservation requirements are included in the FSAP, Table FSAP-1.

7.1 FIELD ANALYTICAL PROCEDURES

Field analytical and test procedures include the following:

Soil
XRF - Total Lead

The SOP for this device is located in Attachment FSAP-A of the Field Sampling and Analysis Plan, Appendix C of the RD RA Workplan.

Air
TSP Air Monitor
Area Personal Air Monitors

The SOP for these monitors are located in Attachment FSAP-B and FSAP-C of the Field Sampling and Analysis Plan, Appendix C of the RD/RA Workplan.

7.2 LABORATORY ANALYTICAL PROCEDURES

Laboratory analytical test procedures include the following:

Soil:

Total Lead - Method 6010/6020

Treated Soils:

TCLP lead - Method 1311 6010

Off-Site Backfill Source:

Total RCRA Metals – Method 6010/6020/7471
TPH - Method 8015 (SVOC analysis (Method 8270C) may be required depending on TPH levels)
VOCs – Method 8260
Pesticides, PCBs – Method 8081

Air Monitors:

Total lead and particulate matter less than 10μm (PM_{10}) -

The air analytical results will be provided by Pace Analytical, of . The SOPs for the air monitoring are provided in Attachment FSAP-B, and FSAP- C of the Field Sampling and Analysis Plan.

All SW-846 methods will be used for analysis. Analytical methods and extraction methods for soil, air and backfill are provided in the FSAP, Table FSAP-1.

7.3 LIST OF TARGET COMPOUNDS AND LABORATORY REPORTING LIMITS

The reporting limits are given in Table QAPP-3 through QAPP-7 for the analyses required during the RA. The instrument detection limit is determined once per quarter and is confirmed to be less than the reporting limit. Current instrument and method detection limits are presented in the applicable SOP in Attachment QAPP-B1 through QAPP-B6.

TABLE QAPP-3
Total Metals
Method 6020/7471A Soil Limits

Metal	Matrix	Method	Reporting Limit (mg/Kg)
Arsenic (ICAP)	Soil	SW-6020	5.0
Barium (ICAP)	Soil	SW-6020	5.0
Cadmium (ICAP)	Soil	SW-6020	1.0
Chromium (ICAP)	Soil	SW-6020	2.0
Mercury (CVAA)	Soil	SW-7471A	0.10
Selenium (ICAP)	Soil	SW-6020	5.0
Silver (ICAP)	Soil	SW-6020	1.0
Lead (ICAP)	Soil	SW-6020	1.0

TABLE QAPP-4
Volatile Organic Compounds
Method 8260 Soil Limits

Compound	Reporting Limit (µg/kg)
Dichlorodifluromethane	5
Chloromethane	10
Vinyl chloride	2
Bromomethane	10
Chloroethane	10
Trichlorofluromethane	5
1,1-Dichloroethene	5
Iodomethane	10
Dichloromethane	10
Trans-1,2-Dichloroethene	5
Acrylonitrile	100
methyl-tert-butyl ether	10
1,1-Dichloroethane	5
2,2-Dichloropropane	5
cis-1,2-Dichloroethene	5

TABLE QAPP-4 continued
Volatile Organic Compounds
Method 8260 Soil Limits

Compound	Reporting Limit (µg/kg)
Bromochloromethane	5
Chloroform	5
1,1,1-Trichloroethane	5
Carbon Tetrachloride	5
1,1-Dichloropropene	5
Benzene	5
1,2-Dichloroethane	5
Trichloroethene	5
1,2-Dichloropropane	5
Dibromomethane	5
Bromodichloromethane	5
cis-1,3-Dichloropropene	5
Toluene	5
Trans-1,3-Dichloropropene	5
1,1,2-Trichloroethane	5
1,3-Dichloropropane	5

TABLE QAPP-4 continued
Volatile Organic Compounds
Method 8260 Soil Limits

Compound	Reporting Limit (µg/kg)
Tetrachloroethene	5
Dibromochloromethane	5
1,2-Dibromomethane	5
Chlorobenzene	5
1,1,1,2-Tetrachloroethane	5
Ethylbenzene	5
Total Xylenes	5
Styrene	5
Bromoform	5
Isopropylbenzene	5
Bromobenzene	5
1,1,2,2,-Tetrachloroethane	5
1,2,3-Trichloropropane	5
n-Propylbenzene	5
2-Chlorotoluene	5
4-Chlorotoluene	5
1,3,5-Trimethylbenzene	5

TABLE QAPP-4 continued
Volatile Organic Compounds
Method 8260 Soil Limits

Compound	Reporting Limit (µg/kg)
tert-Butylbenzene	5
1,2,4-Trimethylbenzene	5
sec-Butylbenzene	5
1,3-Dichlorobenzene	5
p-Isopropyltoluene	5
1,4-Dichlorobenzene	5
1,2-Dichlorobenzene	5
n-Butylbenzene	5
1,2-Dibromo-3-chloropropane	5
1,2,4-Trichlorobenzene	5
Hexachlorobutadiene	5
Napthalene	5
1,2,3-Trichlorobenzene	5

TABLE QAPP-5
Total Petroleum Hydrocarbons (TPH)
Method 8015

Compound	Matrix	Reporting Limit (ppm)
TPH [see note]	Soil	20

Note: Backfill material will be sampled for TPH. If TPH levels exceed the petroleum faction residual saturation concentrations listed in Table I under Ohio Rule 3745-300-8 (8 to 40 mg/Kg for glacial till to silty clay soils) the till material will then be smapled for semi-volatile organic compounds as listed below.

TABLE QAPP-6
Semi-Volatile Organic Compounds (SVOCs)
Method 8270

Parameter	Reporting Limit (mg/Kg)
Acenaphthene	0.2
Acenaphthalene	0.2
Anthracene	0.2
Benzidene	1.0
Benzoic Acid	0.2
Benzo(a)anthracene	0.2
Benzo(b)fluoranthene	0.2
Benzo(k)fluoranthene	0.2
Benzo(a)pyrene	0.2
Benzo(g,h,i)perylene	0.2
Benzyl alcohol	0.2
Bis(2-ethylhexyl)phthalate	0.2
Chrysene	0.2
Dibenzo(a,h)anthracene	0.2
Dibenzofuran	0.2
Di-n-butylphthalte	0.2

TABLE QAPP-6 continued
Semi-Volatile Organic Compounds (SVOCs)
Method 8270

Parameter	Reporting Limit (mg/Kg)
1,2-dichlorobenzene	0.2
1,4-dichlrorbenzne	0.2
2,4-dichlorophenol	0.2
2,6-dichlorophenol	0.2
2,4-dimethylphenol	0.2
2,4-dinitrotoluene	0.2
2,6-dinitortoluene	0.2
Di-n-octophthalate	0.2
Fluoranthene	0.2
Fluorene	0.2
Hexachlorobenzene	0.2
Hexachlorobutadiene	0.2
Hexachlorocyclopentadiene	0.2
Hexachloroethane	0.2
Indeno(1,2,3-cd)pyrene	0.2
Isophotone	0.2
2-Methylnaphthalene	0.2
2-Methylphenol	0.2
4-Methylphenol	0.2
Naphthalene	0.2
2-Nitroaniline	0.2
4-Nitroaniline	0.2
Nitrobenzene	0.2
2-Nitrophenil	0.2

TABLE QAPP-6 continued
Semi-Volatile Organic Compounds (SVOCs)
Method 8270

Parameter	Reporting Limit (mg/Kg)
4-Nitrophenol	0.2
Pentachlorophenol	0.2
Perylene	0.2
Phenantharene	0.2
Phenol	0.2
Pyrene	0.2
Pyridine	0.2
Carbozole	0.2
1,2,4-Trichlorobenzene	0.2
2,4,6-Trichlorophenol	0.2

TABLE QAPP-7
Pesticides/PCBs
Method 8080 Soil Limits

Compound	Reporting Limit (mg/Kg)
Aldrin	0.5
Alpha-BHC	0.5
Beta-BHC	0.5
Delta-BHC	0.5
Chlordane	0.5
4,4'-DDD	0.5
4,4'-DDE	0.5
4,4'-DDT	0.5
Dieldrin	0.5
Endosulfan I	0.5
Endosulfan II	0.5
Endosulfan Sulfate	0.5
Endrin Aldehyde	0.5
Heptachlor	0.5
Heptachlor epoxide	0.5
Lindane	0.5
Methoxychlor	0.5
Toxaphene	0.5
Aroclor 1221	0.5
Aroclor 1242	0.5
Aroclor 1248	0.5
Aroclor 1254	0.5
Aroclor 1260	0.5

8.0 QUALITY CONTROL CHECKS

Internal QC procedures are designed to ensure and document the overall quality of data. Two types of QC checks will be employed to evaluate the performance of the laboratory's analytical procedures. The QC checks represent the system checks and controlled samples introduced into the sample analysis stream that are used to validate the data and calculate the accuracy and precision of the chemical analysis program.

Project QC checks are accomplished by submitting controlled samples into the laboratory from the field. Two external types of QC samples will be used: blanks and duplicates. A duplicate sample will be collected for every 10 samples per matrix or one duplicate per day, whichever is greater. Any samples submitted as "blind" samples will be noted in the field logbook and given a sample number that does not indicate to the laboratory that the sample is a QC check.

8.1 FIELD QUALITY CONTROL CHECKS

For field XRF soil analyses, a laboratory sample will be sent to the laboratory for confirmatory total lead analysis for ten percent of the investigatory samples. Table QAPP-14 presents the QA criteria for field measurements.

8.2 LABORATORY QUALITY CONTROL CHECKS

Laboratory QC checks are accomplished through the use of system checks and QA/QC samples that are introduced into the same analysis stream. Laboratory system checks and QA/QC samples for inorganics are defined below.

- Calibration Blank - A volume of acidified de-ionized water.
- Continuing Calibration - Analytical standard run every 10 analytical samples or every two hours, whichever is more frequent, to verify the calibration of the analytical system.
- Instrument Calibration - Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity, and dynamic range of the instrument to target compounds.
- Preparation Blank - An analytical control that contains deionized water and reagents, carried through the entire analytical procedures. An aqueous method blank is treated with the same reagents as a sample with a water matrix; a solid method blank is treated with the same reagents as a soil sample.

Laboratory QA/QC checks will be performed and samples will be analyzed at a frequency established by appropriate SW-846 protocols for inorganic compounds and appropriate SOPs for analytical methods. Attachment QAPP-C defines all the GeoAnalytical, Inc. QC check criteria for this project. Any QC checks that do not meet acceptance criteria will be handled as discussed in Section 13.0 of the QAPP.

Table QAPP-8
FIELD QC CRITERIA

PARAMETER	METHOD[1] REFERENCE	PRECISION[2]	ACCURACY[2]	COMPLETENESS
SOIL				
Field XRF	Per ENTACT SOP	± 30%	N.A.[3]	90%

NOTES:

1 Methods: E. - *Method for Chemical Analysis for Water and Wastes* (U.S. E.P.A. 1983)
SW-XXXX = *Methods for the Analysis of Solid Waste* (SW-846)

2 Acceptable accuracy and precision based on the range of measurement. The XRF will be used for screening purposes only and to guide depths of excavation during remedial activities. Laboratory confirmation samples will be the determining factor as to whether cleanup criteria is achieved.

N.A. - Not Applicable

9.0 DATA REDUCTION, VALIDATION AND REPORTING

All data collected will be managed, distributed, and preserved to substantiate and document that data are of known quality and are properly maintained. Technical data will be tracked and validated to monitor the performance of the tasks. An outline of the QC data handling process for data collection, transfer, validation, reduction, reporting, and storage for both field and laboratory QC data is described below. The ENTACT QA Manager is responsible for these tasks.

9.1 DATA REDUCTION

Data quality and utility depends on many factors, including sampling methods, sampling preparation, analytical methods, quality control, and documentation. Once all physical and chemical data are validated and assembled, these data are further evaluated with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Satisfaction of these criteria will be documented as listed below. Chemical data must meet criteria of (1) quantitative statistical significance, (2) custody and document control, and (3) sample representativeness. Physical data must meet criteria of: (1) sampling location, time, and personnel; (2) documentation; and (3) methodologies.

To determine the quantitative statistical significance of chemical data, the following items will be documented as appropriate:

- Laboratory field instrumentation, including calibration data, standard methods, and references;
- Proper sample bottle preparation;
- Laboratory analysis detection limits;
- Analysis of laboratory (reagent) blanks at a frequency of at least one per 20 samples per matrix;
- Analysis of laboratory spikes at a frequency of at least 1 per 20 samples or one per analytical batch;
- Analysis of field replicates (duplicates or splits) at a frequency of at least 1 per 10 samples for each matrix or one per day, whichever is greater;
- Analysis of laboratory replicates (duplicates or splits) at a frequency of at least 1 per 20 samples;
- Presentation of tabulated QC data; and
- QA QC certification of the laboratory and or participation in round-robin testing by and/or with EPA accredited agencies.

To evaluate the custody and document control for samples and results, the following items will be documented:

- Field custody noted in field logbook or chain-of-custody documentation available;
- Samples hand-delivered to laboratory or chain-of-custody documentation available;
- Laboratory custody documented by chain-of-custody documentation from either field personnel or shipper;
- Laboratory custody documented through designated laboratory sample custodian with secured sample storage area;
- Sample designation number(s) traceable through entire laboratory monitoring system;
- Field notebooks and all custody documents stored in secure repository or under the control of a document custodian;

- All forms filled out completely in indelible ink without alterations except as initials;
- Identity of sampler; and
- Date of sample collection, shipping, and laboratory analysis.

To determine sample representativeness the following items must be checked:

- Compatibility between appropriate field and laboratory measurements or suitable explanation of discrepancy;
- Analysis within holding time limits suitable for the preservation and analysis methods used;
- Sample storage within suitable temperature, light, and moisture conditions;
- Proper sample containers used;
- Proper sample collection equipment used and properly decontaminated;
- Proper sample preservation;
- Proper laboratory preparation techniques used;
- An evaluation of factors to determine bias screening; and
- Sample site selection criteria to provide representativeness.

To evaluate the field physical data that support the analytical data, the following items will be documented:

- Sampling date and time;
- Sampling personnel;
- Sampling location;
- Physical description of sampling location;
- Sample collection technique;
- Field preparation techniques;
- Visual classification of sample using an accepted classification system;
- A thorough description of the methodology used and a rationale for the use of that methodology;
- Complete documentation of record-keeping practices;
- Field notebook and all custody documents stored in a secure repository or under the control of a document custodian; and
- All forms filled out in indelible ink without alterations except as initialed.

9.1.1 Field Data Reduction Procedures

Field data reduction is not anticipated for this project. The data will be generated from direct readout instruments. The data is then downloaded by RS-232 computer port to a database spreadsheet. The field XRF values will be entered into the field logbook so data transcription errors can be discerned easily upon validation. Temperature, pH, specific conductance and turbidity measurements will be transcribed directly from direct read instruments. The information will be entered into the field logbook and checked for transcription errors by the sampling team.

9.1.2 Laboratory Data Reduction Procedures

Reduction procedures in the laboratory will be performed by computer database that will provide

printouts of raw data and chromatograms. The information will be evaluated by the bench analyst to ensure proper integration and assignment of various sample constituents. Lab records will note all other information not processed by computer such as reagents, sample preparations, etc.

The department supervisor will review the lab notebook and associated computer printouts to ensure all information is accurate and no errors have occurred. Prior to laboratory release of the data, QA QC will be performed to assess precision and accuracy requirements of the data have been met.

9.2 DATA VALIDATION

Technical data, including field data and results of laboratory sample analyses, will be validated to monitor the performance of the remedial action. The data collection and quality assurance procedures for validating field and laboratory data are described below.

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 investigative analytical samples.

9.2.1 Procedures Used to Validate Field Data

Validation of data obtained from field measurements will be performed by the ENTACT QA Manager. Such validation will be performed by regularly checking procedures utilized in the field and comparing the data to previous measurements. Data that cannot be validated will also be documented.

Field data requiring validation includes the raw data and supportive documentation generated from field investigations and will include, but is not limited to, the following:

- Field notebooks
- Field investigation daily reports
- Field instrument readings and calibration data sheet;
- Field log borings;
- Sample labels;
- Chain-of-custody forms;
- Sample tracking records;
- Surveying information; and
- Maps.

Field measurements that could affect the quality of the data (such as temperature, pH, conductivity, and water level) will also be validated. Validation of all field data will be performed in terms of meeting DQOs by checking the procedures utilized in the field and comparing the data to previous measurements. The following areas will be addressed during validation:

- Sampling methodology;
- Sample holding times and preservation;
- Field instrument selection and use;
- Field instrument calibration and standardization;

- Field instrument preventative and remedial maintenance;
- Field deviations; and
- Units of measure and reference points from which field data will be measured.

Additional specific evaluations of data critical to the integrity of the decision making process for this task will be performed on 10 percent of the data and will include:

- Chain-of-custody integrity check;
- Review of the appropriateness of field methodologies;
- Transcription, calculation, completeness, and accuracy check of field data; and
- Analysis of field notes to determine presence of bias.

If substantial errors are detected which impact data quality, the scope of the validation will be increased to determine the extent of the problems.

9.2.2 Procedures Used to Validate Lab Data

Under the direction of the Laboratory QA Manager, lab data will be reviewed to ensure that results for samples meet all method-specified criteria. The requirements to be checked in validation are:

- Sample Holding Times
- Calibration
- Blanks
- Matrix Spike/Matrix Spike Duplicate
- Field Duplicate
- Target Compound Identification
- Spectral Interference Check Sample Analysis
- Compound Quantitation and Reported Detection Limits
- System Performance
- Overall Assessment of Data
- Interference Check Sample Analysis
- Laboratory Control Sample Analysis

One equipment blank will be prepared and documented for every 10 investigative samples to assess the accuracy of sampling techniques. One matrix spike and matrix spike duplicate will be analyzed for every 20 investigative samples.

The laboratory QA Manager will be responsible for assessing data quality and advising appropriate laboratory section supervisors of any data that are "unacceptable" or have notations that would caution the data user to possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- Raw data produced by the analyst will be turned over to the respective supervisor.
- The supervisor will review the data for attainment of QC criteria as outlined in method protocols and established U.S. EPA methods.

- Upon completion of analytical testing, the laboratory project manager conducts a final review.
- Upon acceptance of the data by the laboratory project manager, a computerized report will be generated and sent to the ENTACT QA Manager.
- The ENTACT QA Manager will complete a thorough audit of all reports.

The ENTACT QA Manager will conduct an evaluation of data reduction and reporting by the laboratory. These evaluations will consider the finished data sheets, calculation sheets, document control forms, blank data, duplicate data, and recovery data for matrix and surrogate spikes. The material will be checked for legibility, completeness, and the presence of necessary dates, initials, and signatures. The results of these checks will be assessed and reported, noting any discrepancies and their effect upon acceptability of the data. In addition, the QA Manager will check for data consistency by assessing comparability of duplicate analyses, comparability to previous criteria, transmittal errors, and anomalously high or low parameter values. The results of these checks will be reported in writing.

The following is a description of the validation steps that will be used by the ENTACT QA Manager to validate the laboratory data. These validation results will be summarized in the Final Report. The validation steps are as follows:

- Compile a list of all samples
- Compile a list of all QC samples
- Review laboratory analytical procedures and instrument performance criteria
- Specific evaluations critical to the integrity of the data include:
- Review of chain-of-custody documents for completeness and correctness;
- Transcription, calculation, completeness, and accuracy check; and
- Review of laboratory analytical procedures, appropriateness, and instrument performance criteria.

In addition, 10 % of the data will undergo a complete evaluation back to the raw data. If significant errors that affect data quality are detected, the percentage of raw data validated will be increase to assess the magnitude of the problem.

- A data summary will be prepared and will include:
  - Results;
  - Sample media identification
  - Sample location and description;
  - Appropriate concentration units;
  - Appropriate significant figures;
  - Data qualifiers; and
  - Definitions

  - The laboratory data summary will be reviewed for potential data quality problems, including:
    - Unexpected results;
    - Common laboratory contaminants;
    - Samples in which dilution was necessary;
    - Time and date of sample collection.

A sample data summary will be prepared to assess precision, accuracy, and completeness of the analytical data. Laboratory records and data package requirements will be checked to assess completeness of the data package. The validation effort will be done by personnel qualified and experienced in the field of laboratory data validation.

Despite all efforts to achieve the objectives of the project, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from the laboratory with data entered into the data base management system.

9.3 DATA REPORTING

Data generated during the MMI removal activities will be appropriately identified, validated, and summarized in monthly progress reports, and included in the final report. The ENTACT QA Manager will develop a data storage and information system to facilitate and manipulate data for tracking, data calculations, and transfer of data to various forms and reports and transmittal of data into a data storage system Data packages from the laboratory will be in the form of a Level 3 QC package excluding a sample traffic report and electronic deliverables.

Data reporting to the ENTACT QA Manager will be performed by the ENTACT QA Technician and the Field Coordinator. After data validation and reduction, the ENTACT QA Technician will report data to the ENTACT QA Manager. The ENTACT QA Manager will summarize the data obtained and include the information in the field activity report submitted to the Project Manager for review. The ENTACT Project Manager will then prepare monthly reports and the final report to the U.S. EPA Project Coordinator. The appropriate documents will be prepared and distributed that summarize both the field activities performed and the results obtained. The field reports will include: presentation of results, summaries of field data from field measurements, and field location of sampling points. All other information will be bound in the appendices. The laboratory reports will include at a minimum the following components:

- Report title page;
- Date of issuance;
- Any deviations from the intended analytical strategy;
- Laboratory batch number;
- Number of samples and respective matrices;
- Project name and number;
- Condition of samples;
- Discussion of holding times;
- Discussion of technical problems or observations;
- Discussion of quality control checks which failed;
- Sample description information;
- Analytical tests assigned;
- Analytical results;
- Quality control reports;
- Description of analytical methodology;

- Description of QC methodology; and
- Signature of Laboratory Operations Manager.

Both the field and laboratory reports will contain the following:

- Any changes in the QA Project Plan;
- Significant QA problems, recommended solutions, and results of corrective actions;
- Discussions of whether the QA objectives were met, and the resulting impact on decision making; and
- Limitations on the use of the measurement data.

10.0 PERFORMANCE AND SYSTEMS AUDITS

Two types of audit procedures will be used to assess and document performance and project staff: system audits and performance audits. These audits are performed at frequent intervals under the direction of the ENTACT QA Manager to evaluate quantitatively the accuracy of the total measurement system. These audits form the basis for corrective action requirements and provide a permanent record of the conformance of measurement systems to QA requirements.

System audits consist of quantitative evaluation of field and laboratory quality control measurement systems to determine if they are used appropriately. These audits may be carried out before all systems are operational, during the program, or after the completion of the program. These audits involve a comparison of the activities presented in the QA plan with those actually scheduled or performed.

Performance audits are a quantitative evaluation of the measurement systems of the program. They require testing of the measurement systems with samples of known composition or behavior to evaluate precision and accuracy after systems are operational and generating data. Analytical laboratories designated to perform analytical services during the removal action at MMI will be audited prior to sample analysis.

10.1 INTERNAL AUDITS

A systems audit will be performed prior to or shortly after systems are operational on laboratory, office, and field operations. The system audit protocols are summarized as follows:

Laboratory Operations: Laboratory QA Manager
- Parameter and or laboratory notebooks;
- Instrument equipment logbook;
- Sample log-in, routing, and labeling for analysis; and
- Updating of QC criteria for spike recoveries. In addition, the QA Manager will monitor analyses to assure complete adherence to approved analytical methods.

Field Operations: ENTACT QA Officer
- Field notebooks, procedures, field logs, boring logs, etc.
- Site safety;
- Sampling methods; and
- Sample labeling, packing, storage, shipping, and chain-of-custody procedures.

Office Operations: ENTACT Administrative Project Manager
- Project team members are informed of the team organization and in particular the quality control procedures for their work assignment; and
- Quality control officers assigned to the project are available and informed of the quality control they are responsible for, and the schedule for quality control review.

After systems are operational and generating data, a performance audit will be conducted at least once during the laboratory, office, and field work to determine the accuracy of the total measurement systems

or component parts thereof. The performance audit protocol is summarized as follows:

Laboratory Operations: Laboratory QA Manager
- Sample log-in, routing, and labeling for analysis;
- Analyses to assure complete adherence to approved test methods; and
- Other quality control procedures outlined herein.

Field Operations: ENTACT QA Officer
- Field notebooks, procedures, field logs, boring logs, etc.
- Site safety;
- Sampling methods; and
- Sample labeling, packing, storage, shipping, and chain-of-custody procedures.

Office Operations: ENTACT Administrative Project Manager
- Specified quality control reviews of the work are being performed;
- The individuals performing the quality control reviews are qualified and as assigned; and
- Final reports and deliverables have received the appropriate QC review.

The auditor will maintain a record of his evaluation by writing field notes. Following the audit, the preliminary results will be reviewed with the person in charge of the operations audited. Subsequent to the audit, the auditor will develop an audit report that summarizes the areas requiring corrective measures. This report will be submitted to the ENTACT Project Manager.

When it is necessary to determine the capacity of a subcontractor's quality assurance program prior to award of subcontractor, the ENTACT Project Manager, ENTACT QA Technician, and or ENTACT QA Manager will visit the subcontractor's operations to verify performance and services.

10.2 EXTERNAL AUDITS

In addition to these internal field and laboratory audits, the USEPA Region 5 QA reviewer from FSS may conduct external field and laboratory audits. External field and laboratory audits may also be performed by the US EPA Project Coordinator. The external field audits may be conducted any time during the field operations and may or may not be announced. An external audit may be performed at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced. The external lab audit will include (but not be limited to) review of laboratory procedures, laboratory on-site audits, and or submission of performance verification samples to the laboratory for analysis.

11.0 PREVENTATIVE MAINTENANCE

To minimize the occurrence of instrument failure and other system malfunction, a preventative maintenance program for field and laboratory instruments will be implemented. Equipment, instruments, tools, gauges, and other items requiring preventative maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedures developed by the operators. Maintenance items that cannot be performed by the laboratory technician will be performed by a person certified to repair the instrument. The laboratory will be responsible for performing routine maintenance and will have available tools and spare parts to conduct routine maintenance. A backup XRF unit will be available for use in the case of a malfunction to avoid downtime.

Manufacturer's procedures identify the schedule for servicing critical items in order to minimize the downtime for the measurement system. It will be the responsibility of the field instrument operator and the laboratory to adhere to this maintenance schedule and arrange any necessary and prompt service. In addition to any manufacturer recommended maintenance criteria, a maintenance procedure will be developed by the operator based upon experience and previous use of the equipment. Service to the equipment, instruments, tools, gauges, etc., shall be performed by qualified personnel. Periodic maintenance is shown on Table QAPP-9.

Logs are used to record maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Any items found to be inoperable will be taken out of use and a note stating the time and date of this action will be made in the calibration sheets and logs. The reason for equipment failure and the time and date of its return to service will also be noted in the logbook. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the site. The ENTACT Project Manager will audit these procedures.

Table QAPP-9
Maintenance Procedures for Field and Laboratory Equipment

Instrumentation	Maintenance Procedure	Spare Parts
Field XRF	1. Leak testing every six months 2. Shutter check every six months 3. Annual manufacturer servicing	Battery packs XRF Cables
Gas Chromatograph Mass Spectrometer	1. Change septa as needed 2. Change syringes on autosamplers as needed 3. Leak check when installing columns 4. Injection port cleaning as needed 5. Check inlet system for residue buildup periodically 6. Clean gas line dryers as needed 7. Replace pump oil as needed 8. Replace electron multiplier as needed	Syringe Septa Various electronic components Plumbing supplies Injection port liners
Graphite Furnace Atomic Absorption Spectrometer	9. Change graphite contact rings as needed 10. Clean quartz windows as needed 11. Change tubes as needed	Contact rings Tubes
ICP Spectrometer	1. Change sample rinse lines 2. Clean nebulizer components and torch assembly 3. Clean filters 4. Clean mirrors	Nebulizer components Torch assembly Pump tubing Sample probe
Temperature pH Conductivity and turbidity meters	1. Calibrate as required by manufacturer's instruction 2. Replace as needed 3. Check batteries if does not calibrate	pH buffers Batteries Spare electrodes

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

This section summarizes the QA QC procedures used in assessing the quality of the chemical data and the format for presenting the results of the QA/QC evaluations. The data evaluation procedures will be used by the QA Manager for assessing duplicate and spike samples and checking blank samples that are submitted blind to the analytical laboratories from the field or generated internally by the laboratory, in accordance with this QAPP. The purpose of implementing these procedures is to assess the chemical data generated for accuracy, precision, representativeness, and completeness for both the laboratory analytical program and field sample collection activities.

The primary goal of the program is to ensure that the data generated are representative of environmental conditions at the site. Accuracy, precision, representativeness, and completeness will be computed in the manner described in the following paragraphs. A qualitative assessment of accuracy, precision, representativeness, and completeness will be made and documented. The goal of the assessment will be to (1) establish site specific PARCC parameters; (2) use the parameters to develop a database with known limitations of data usability; and (3) evaluate these limitations in achieving the project DQOs. Complex statistical data verification and a significance evaluation will not be performed. If a problem arises and the data are found to deviate from previous analyses or surrounding conditions, the data will be annotated. Sample recollection and analysis will be used only in extreme cases of QC problems.

Chemical data will be evaluated according to accuracy, precision, representativeness, and completeness criteria for both the field sample collection activities and laboratory analytical programs. The QA/QC program will evaluate data based on three types of quality control samples (matrix spikes, blanks, and duplicates).

The completeness of the data represents the amount of valid data obtained from the field programs versus the amount of data expected under normal conditions. Completeness will be assessed prior to preparation of the final report. These procedures for evaluating the field and laboratory QA QC data are the same and are presented below for QA/QC matrix spike, blank, and duplicate samples.

12.1 ACCURACY ASSESSMENT

In order to assure the accuracy of the analytical procedures, an environmental sample is randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analyte to be evaluated. In general, a sample spike should be included in every set of 20 samples tested on each instrument. The spike sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%\ \text{Recovery} = \frac{\text{Amount in spiked sample} - \text{Amount in sample}}{\text{Known amount added}} \times 100$$

12.2 PRECISION ASSESSMENT

Spiked samples are prepared by choosing a sample at random from each sample shipment received at the laboratory, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. The duplicate samples are then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the spike and duplicate spike are calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Spike 1 - Amount in Spike 2}}{0.5\,(\text{Amount in Spike 1} + \text{Amount in Spike 2})} \times 100$$

12.3 COMPLETENESS ASSESSMENT

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{(Number of valid measurements)}}{\text{(Number of measurements planned)}} \times 100$$

13.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected. When a significant condition adverse to quality is noted at the site, laboratory, or subcontractor locations, the cause of the condition will be determined and corrective action taken immediately. All project personnel have the responsibility to promptly identify, solicit approved correction, and report conditions adverse to quality. Conditions, which warrant corrective action, include:

- Predetermined acceptance standards are not attained;
- Procedures or data compiled are determined to be faulty;
- Equipment or instrumentation is found to be faulty;
- Samples and test results are questionably traceable;
- Quality assurance requirements have been violated; and
- System and performance audits indicate problems.

13.1 FIELD CORRECTIVE ACTION

The need for corrective action will be identified as a result of the field audits previously described. If problems become apparent that are identified as originating in the field, immediate corrective action will take place. If immediate corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. When a corrective action is implemented, the effectiveness of the action will be verified such that the end result is elimination of the problem.

Corrective action in the field can be needed when the sample network is changed, sampling procedures, and field analytical procedures require modification due to unexpected conditions. In general, the Field Team, Field Coordinator, QA Technician, QA Manager, and Project Manager may identify the need for corrective action. The ENTACT field staff in consultation with the ENTACT Field Coordinator will recommend the corrective action. The ENTACT Field Coordinator will approve the corrective measure, which will be implemented by the ENTACT Field Team. It will be the responsibility of the ENTACT Field Coordinator and the ENTACT Project Manager to ensure that corrective action has been implemented.

If the corrective action will supplement the existing sampling plan using existing and approved procedures in the QAPP, corrective action approved by the ENTACT Field Coordinator will be documented. If corrective actions resulting in fewer samples, alternate locations, etc. which may cause project quality assurance objectives not to be achieved, it will be necessary that all levels of project management, including U.S. EPA, concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The ENTACT QA Manager will identify deficiencies and recommended corrective action to the ENTACT Project Manager. Implementation of corrective actions will be performed by the ENTACT Field Coordinator and the ENTACT Field Team. Corrective action will be documented in quality assurance reports to the entire

project management. The U.S.EPA will be notified immediately if any problems affecting data quality occur.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the U.S. EPA Remedial Project Manager.

13.2 LABORATORY CORRECTIVE ACTION

The need for corrective action resulting from QA audits will be initiated by the laboratory QA QC Manager in consultation with the Laboratory Operations Manager. The corrective action will be performed prior to the release of data from the laboratory. The corrective action will be documented in the logbook and submitted to the data validator. If the corrective action does not rectify the situation, the laboratory will contact the ENTACT Project Manager. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform all levels of ENTACT management at the MMI site and the U.S. EPA Project Coordinator. Corrective action may include, but is not limited to:

- Reanalyzing the samples, if holding time criteria permit;
- Evaluating and amending sampling and analytical procedures;
- Accepting data with an acknowledged level of uncertainty; and
- Resampling and analysis, if the completeness of the data set or intended use of the data is recognized during a preliminary review to be insufficient to meet program DQOs.

If the above corrective actions are deemed unacceptable, an alternate laboratory will be selected to perform necessary analyses.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The facility may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, and whether the data to be collected is necessary to meet the required quality assurance objectives (e.g. the holding time has not been exceeded, etc.). The ENTACT QA Manager is responsible for identifying a corrective action situation, documenting the incident, determining the course of action, and implementing the corrective action.

13.4 IMMEDIATE CORRECTIVE ACTION

Any equipment and instrument malfunctions will require immediate corrective actions. The laboratory QC charts are working tools that identify appropriate immediate corrective actions to be taken when a control limit has been exceeded. They provide the framework for uniform actions as part of normal operating procedures. The actions taken should be noted in field or laboratory logbooks. A detailed description of method-specific corrective action limits is provided in the appropriate method. Any deviation from the prescribed control limits must be approved in writing by the ENTACT QA Manager.

13.5 LONG-TERM CORRECTIVE ACTION

The need for long-term corrective action may be identified by standard QC procedures, control charts, and system audits. Any procedural or data quality problem that cannot be solved by immediate corrective action becomes a long-term corrective action. The essential steps in a corrective action system are as follows:

- Identification and definition of the problem;
- Investigation and determination of the cause of the problem;
- Determination and implementation of a corrective action to eliminate the problem; and
- Verification that the corrective action has eliminated the problem.

Documentation of the problem is important in corrective action. The responsible person may be an analyst, ENTACT QA Manager, laboratory QA Manager, sampler, or the ENTACT Project Manager. In general, the designated QA Manager will investigate the situation and determine who will be responsible for implementing the corrective action. The QA Manager will verify that the corrective action has been taken, appears effective, and that the problem has been resolved.

The required corrective action will be documented by the designated ENTACT QA Manager and the ENTACT Project Manager for field activities. The corrective action will be discussed with the ENTACT Project Manager and the EPA Project Manager prior to implementation if the severity of the problem warrants such discussion.

Any changes proposed for amending sampling and analytical procedures will be approved by the EPA prior to implementation. These changes will be documented in monthly progress reports and addenda to the QAPP.

Project management and staff, including field investigation teams, document and sample control personnel, and laboratory groups, will monitor on-going work performance in the normal course of daily responsibilities. Work will be monitored at the site by the ENTACT Project Manager.

Following identification of an adverse condition or quality assurance problem, the ENTACT QA Manager will notify the ENTACT Project Manager of the problem.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 CONTENTS OF A PROJECT QA REPORT

Analytical results of samples analyzed during the remedial action will be submitted to the Project Manager following a QA/QC review. The results will include a tabulation of the analytical data and an explanation of any field conditions or laboratory QA/QC problems and their effects on data quality. Results of performance audits and system audits will also be included, as appropriate. Proposed corrective action will be recommended in the event that QA problems are identified during review of data quality or results of performance or system audits.

The final report will contain a discussion of QA/QC evaluations summarizing the quality of the data collected and/or used as appropriate to each activity of the project. The objective of the QA/QC summary will be to ensure that the data are representative of site conditions and sufficient in quality and quantity to support the field activities. The QA/QC summary will include:

- Tabulated results of all field and analytical data;
- A report from the laboratory QA Manager evaluating the validity of the analytical data with respect to accuracy, precision, completeness, and representativeness; and
- A report from the Project Manager evaluating the results of field and office audits.

A quality assurance report will be prepared by the QA Manager upon receipt of sufficient QA data from the laboratory. The report will be a summary of QA/QC results of the analytical work conducted and will be included as part of the final remedial action report.

14.2 QA REPORTING AND ROUTING SCHEDULE

The QA Reports will be prepared on a monthly basis and will be delivered to all recipients by the end of the first full week of the month. The reports will continue without interruption, until the project has been completed. All individuals identified in the Project Organization Chart will receive copies of the monthly QA Report.